UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/838,084	04/18/2001	Guo-Qiang Lo	IDT-1651	9576

27158 7590 04/04/2003

BEVER, HOFFMAN & HARMS, LLP
2099 GATEWAY PLACE
SUITE 320
SAN JOSE, CA 95110

EXAMINER	
FOONG, SUK SAN	
ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 04/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/838,084	LO ET AL.	
	Examiner	Art Unit	
	Suk-San Foong	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) *5-10* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 11-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 2 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song et al. ('823) in combination with Leung et al. ('781) and Ghandi.

Song et al. teach a method of forming trench isolation of a semiconductor device which includes forming pad oxide layer 114 over substrate 110 (Col. 4, lines 31-34 and lines 38-40, and Fig. 4), then forming silicon nitride layer 120 as hard mask layer over pad oxide layer 114 (Col. 4, lines 40-43), subsequently forming silicon oxynitride layer 122 as an anti-reflective layer over silicon nitride layer 120 (Col. 4, lines 48-50), then patterning and developing photoresist layer

150 over silicon oxynitride layer 122 by photolithography (Col. 4, lines 34-36), then etching through pad oxide layer 114, silicon nitride layer 120 and silicon oxynitride layer 122 (Col. 4, lines 51-56, and Fig. 5), subsequently etching through substrate 110 thereby forming trench 123 (Col. 4, lines 57-62, and Fig. 6), then forming liner oxide layer 125 (Col. 5, lines 37-45), and subsequently depositing insulating layer 130 in trench 123 (Col. 5, lines 50-54).

The combination process does not teach the step of conditioning the silicon oxynitride layer after trench formation.

Leung et al. discloses a method of forming a trench in semiconductor devices which includes providing silicon substrate 24 (Col. 3, lines 6-7, and Fig. 3), the forming pad oxide layer 26 over substrate 24 (Col. 3, lines 7-9), then forming and patterning photoresist layer 28 over pad oxide layer 26 (Col. 3, lines 8, 14-16), subsequently etching substrate 24 to form trench 40 (Col. 3, lines 37-40, and Fig. 5), and then removing photoresist layer 28 (Col. 3, lines 61-62), forming sacrificial oxide layer 44 by thermal oxidation on walls of trench 40 (Col. 3, lines 58-60, and Fig. 6), subsequently removing sacrificial oxide 44 using wet etching solution such as HF (Col. 4, lines 14-18, and Fig. 7).

It would have been within the scope to one ordinary skill in the art to combine the teachings of Leung et al. with Song et al. because it would enable formation of sacrificial oxide 44 in the process of Song et al. and obtain further advantage of rounding of trench corners and having damage free trench walls (Leung et al., Col. 4, lines 24-28).

In regard to claim 2, the step recited in lines 1-2 would be obtained as the same materials are being treated the same as the instant invention.

The combination process does not teach the step as recited in claim 1, lines 11-14.

Ghandhi teaches cleaning surface of semiconductor wafers after each processing step in a fabrication using wet cleaning process (p. 641).

It would have been within the scope to one ordinary skill in the art to combine both teachings-it would enable wet cleaning after formation of sacrificial oxide layer 44 of the combination process to be performed and obtain further advantage of reducing contaminants and avoiding operator error.

4. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song et al. ('823) in combination with Leung et al. ('781) and Ghandi as applied to claims 1, 2 and 11 above, and further in view of Ballatine et al. ('070).

The combination process does not disclose the steps as recited in claims 3 and 4.

Ballantine et al. teachings a method of forming a shallow trench isolation structure in semiconductor device which includes providing silicon substrate 1 (Col. 2, lines 6-7, and Fig. 5), then forming pad oxide 2 and nitride layer 3 over substrate 1 (Col. 2, lines 8-10), subsequently forming mask layer 5 over nitride layer 3 (Col. 2, lines 11-15, and Fig. 6), then forming trench 6 by etching through nitride layer 3, pad oxide 2 and substrate 1 (Col. 2, lines 16-20, and Fig. 7), subsequently forming oxide liner 8 in trench 6 by rapid thermal oxidation process at a temperature of about 900 to 1300°C for 1 second to less than 3 minutes (Col. 2, lines 30-43), subsequently filing trench 6 with insulating material (Col. 3, lines 16-24, and Fig. 10), and then planarizing trench 6 by chemical-mechanical polishing process (Col. 3, lines 25-36, and Figs. 11 and 13).

It would have been within the scope to one ordinary skill in the art to combine the teachings of Ballantine et al. with the combination process because it would enable formation of sacrificial oxide layer 44 of the combination process to be performed.

Note the disclosed temperature and duration of the oxidation process are within the recited ranges.

5. Claims 12-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song et al. ('823) in combination with Leung et al. ('781) and Ghandi as applied to claims 1, 2 and 11 above, and further in view of Ballatine et al. ('070).

The combination process does not disclose the steps recited in claim 12.

Wolf teaches patterning photoresist layer by exposing the layer through a reticle in photolithography process (p. 407 and 476)

It would have been within the scope to one ordinary skill in the art to combine the teachings of Wolf with the combination process because it would enable formation of photoresist layer 120 of the combination to be performed.

6. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song et al. ('823) in combination with Leung et al. ('781) and Ghandi as applied to claims 1, 2 and 11 above, and further in view of Applicant's Admitted Prior Art (AAPA).

The combination process does not disclose the step in claim 18.

The combination process does not disclose the step in claim 19.

AAPA discloses a wet cleaning process in the presence of silicon oxynitride layer by using hydrogen fluoride (HF) and buffered oxide etch (BOE) (Instant p. 2-3).

It would have been within the scope to one ordinary skill in the art to combine the teachings of AAPA with the combination because it would enable wet clean step of the combination to be performed.

Response to Arguments

7. Applicant's arguments with respect to claim 1 and claims dependent thereon have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Suk-San Foong whose telephone number is 703-305-0383. The examiner can normally be reached on Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 (7724, 3431, 3432).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

March 27, 2003

George Fourson
Primary Examiner
Art Unit 2823